MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

DCA5231 – COMPUTER ARCHITECTURE

(Diploma in IT)

7 February 2023
2:30 p.m. – 4:30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **2 pages**.
2. Answer **ALL** questions in the **Answer Booklet**.

FOUR Structured Questions (40 Marks)

Question 1 [10 Marks]

a) Given that the program counter (PC) holds 505, the address of the current instruction, execute **FIVE** instructions starting from 505. Show the calculations and contents of the registers (Program Counter – PC, Instructions Register – IR and Accumulator – AC), as well as any changes made to the memory at the end of each instruction. Refer to Figure 1 for the memory content and partial list of opcodes. (4 marks)

Address	Content
505	1712
506	5711
507	2713
508	6714
509	5715
...	...
711	A2ED
712	2509
713	5C6B
714	40F8
715	01C9
...	...

Memory content

Instruction	Operation
0001	Load AC from memory
0010	Store AC to memory
0101	Add to AC from memory
0110	Subtract memory from AC

Partial list of opcodes

Figure 1. Memory content and partial list of opcodes

b) Show the steps to perform the following:

i. Convert 252.375_{10} to its binary equivalent. (1 mark)

ii. Convert 675.724_{8} to its hexadecimal equivalent. (1 mark)

iii. Convert $16FB_{16}$ to its decimal equivalent. (1 mark)

iv. Convert 1011011101_{2} to its octal equivalent. (1 mark)

v. Calculate $38_{10} - 90_{10}$ using two's complement in an 8-bit representation. Verify the result. (2 marks)

Question 2 [10 Marks]

$$Z = [E / (A + K) * D] + [(V * J) / (S - G)] - (B * P)$$

a) Show the steps to convert the above infix expression to postfix expression. (2 marks)

b) Write ***zero-address***, ***one-address***, ***two-address***, and ***three-address*** instructions for the above infix expression. (8 marks)

Continued .....

Question 3 [10 Marks]

A computer system has a memory architecture made up of the main memory of **64GB** and a cache of **8MB**. The main memory is arranged in blocks of **32 bytes** to perform an efficient mapping function. Show the calculation for the number of bits required in each field of the address structure for the different mapping functions. Draw the address structure and indicate the fields.

a) Direct Mapping (3 marks)
b) Associative Mapping (3 marks)
c) Four -Way Set Associative Mapping (4 marks)

Question 4 [10 Marks]

a) Describe **THREE** characteristics of the system bus. (3 marks)

b) Explain the programmed I/O technique for I/O operations. (3 marks)

c) Explain instruction pipelining and what happens in the Fetch instruction (FI), Decode instruction (DI), and Execute instruction (EI) stages. (4 marks)

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